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Method and arrangement for monitoring the operating condition of presses, particularly packing presses

Technical field

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The invention relates to a method and an arrangement for monitoring the operating condition of presses, particularly packing presses for the production of pressed objects, such as from scrap and sheet metal wastes.

Prior art

For example, shear packing presses according to DE 198 04 789 are known, which substantially comprise a hopper with cutting edge, compactor with shearing knives guided horizontally therein, a press case arranged at right angles thereto with compactor guided therein and a pack chamber, arranged horizontally and transversely with respect to the hopper and with a compactor guided horizontally.

In practical embodiments, hopper and press case open into a common chamber accommodating the pack-like pressed object, the aforementioned pack chamber. The walls of the hopper, press case and pack chamber form the housing of the shear packing press. The pack chamber has an opening for the door to be displaced horizontally, through which the ejected pressed object passes. The compactor and the door are moved by hydraulic pistons/cylinders, which are connected to a hydraulic drive system.

To produce pressed objects, preferably packs, from waste material, in particular from scrap and sheet

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metal wastes, by means of such known shear packing presses

- 5 - a first compaction step for the pre-compaction of
the material put in to the width of the pack is
carried out by means of a compactor guided
horizontally in the hopper, material possibly
projecting beyond the compactor being cut off at
the cutting edge by means of the shearing knife
10 arranged on the compactor,
- 15 - after that, a second compaction step for the
intermediate compaction of the material pre-
compacted to the pack width to the height of the
pack is carried out by means of the compactor
guided in the press case at right angles to the
hopper,
- 20 - then, a third compaction step for the final
compaction of the material to the final density
and length of the pack is carried out by means of
the compactor guided horizontally in the pack
chamber, horizontally and transversely with
respect to the hopper, the finished pack, after
25 reaching the final density and length, being
ejected from the pack chamber through the door,
and
- 30 - finally, the control of these compaction steps is
carried out by means of a drive system producing a
hydraulic pressure.

This basic principle has proven worthwhile in practice
but there is a requirement for functional improvements
35 with regard to monitoring the operating condition of
presses.

In this case, presses are not just understood to mean the type mentioned at the beginning. In the sense of the invention, the requirement for an improvement in the monitoring of the operating condition extends only as far as presses, i.e. machines, in which, because of the relative movement between a driven compactor and a press case or table absorbing the compaction pressure for the pressed object, what is known as a stick-slip effect occurs. This applies to presses that act one-dimensionally, two-dimensionally and also three-dimensionally (specifically of the type mentioned at the beginning).

In presses, this stick-slip effect because of the friction between the surfaces of the machine parts involved sliding on one another is expressed by chattering and/or creaking noises. The cause of this is that, during the aforementioned relative movement, under the action of the relatively high pressures and components turning away from the actual pressing direction, the movement changes from adhesive friction to moving friction and vice versa. The acoustically perceivable oscillations which are therefore produced are in turn produced by the fact that the entire machine, in particular the machine part respectively involved, is set oscillating.

In the extreme case, as a result of a high-frequency frictional movement, the frictional surface respectively involved can weld locally, which is generally designated "fretting". For the machine, this means considerable damage, which can be rectified only with considerable effort. Furthermore, a loss of production arises for the operator, which leads to consequential damages.

Summary of the invention

5 The invention has the object of developing a method and
an arrangement for monitoring the operating condition
of presses, in particular packing presses, damaging
oscillation stresses being detected in good time and
"fretting" of the machine parts involved in the
relative movements being avoided.

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According to the invention, this object is achieved by
the features of claims 1 to 12.

Brief description of the drawings

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In the drawings:

fig. 1 shows the schematically illustrated arrangement
according to the invention using the example of
20 a packing press, in a perspective illustration,

fig. 2 shows a plan view with a schematically
illustrated arrangement according to the
invention.

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Best way of implementing the invention

The invention will be explained in terms of its basic
arrangement and the active principle on a packing press
30 operating three-dimensionally, in accordance with the
following exemplary embodiment.

According to fig. 1, the packing press 1 substantially
comprises a press case 2.2 and a pack chamber 2.3, and
35 a first compactor 3.1 driven by a first piston/cylinder
unit 6.1, and a second compactor 3.2 driven by a second

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piston/cylinder unit 6.2 and a third compactor 3.3 driven by a third piston/cylinder unit 6.3 (fig. 2a). A door 5.1 connected to a fourth piston/cylinder unit 6.4 is guided in a door case 5.2 such that it can be moved horizontally. The door case 5.2 is fixed to the housing part of the pack chamber 2.3 by means of a tie rod 10, the tie rod 10 at the same time absorbing the pressure against the door 5.1 exerted on a pressed object, not illustrated, by the third piston/cylinder unit 6.3 by means of the third compactor 3.3.

In accordance with the erection possibility illustrated in fig. 2 for a hydraulic drive system 9.1 of the packing press 1, said system substantially comprises a control block 9.2, a hydraulic tank 13 and a switch cabinet 16, which form a compact structural unit which can be preassembled on its own. With the switch cabinet 16 is a controller 16.2, which is connected via a connecting cable 16.4, a charge amplifier (coupler) 16.1 and a dimension line 16.3 to a sensor 2.4 on an end wall of the press case 2.2 of the packing press 1.

The following basic series of steps or sequences and combinations are typical of the operation of the packing press 1:

- the pre-compaction of the material by means of the first compactor 3.1 in the first compaction step,
- 30 - the following second compaction step by means of the second compactor 3.2,
- the third compaction step, carried out by means of the third compactor 3.3, in which the first compactor 3.1 is already in a position exposing the opening of the pack chamber 2.3.

In this case, the return strokes of the compactors 3.1, 3.3 can be coupled, the compactor 3.3 then initially covering part of the distance on its own and the remainder of the distance together with the compactor 3.1.

The door 5.1 is closed at the same time as the return stroke of the third compactor 3.3 by means of hydraulic isolation, or opened at the same time as the return stroke of the compactor 3.2 by means of hydraulic isolation.

For all these sequences, use is made of a controller 16.2, which monitors the movement sequences of the compactors 3.1, 3.2, 3.3 and the door 5.1 during the cycles for the production of the pressed object, not illustrated.

These movements sequences of the compactors 3.1, 3.2, 3.3 and of the door 5.1, specifically with the involvement of relatively high forces, in critical positions produce the undesired stick-slip effect already described in more detail at the beginning which, according to the object, is to be detected in good time in order to avoid "fretting" of the machine parts involved in the movement sequences.

By means of the arrangement of the controller 16.2, which is constructionally relatively simple but surprising in its effect, with the sensor 2.4 fitted to the end wall of the press case 2.2 for measuring oscillation amplitudes, the measuring line 16.3 for passing on the measured values with a coupler as charge amplifier 16.1 and a connecting cable 16.4, the method according to the invention is carried out as follows.

Relative movements taking place during the time and/or distance between each compactor 3.1, 3.2, 3.3 and the press case 2.2 and also the door 5.1 in the cycle from the start until the end of the pressing operation and the ejection of the pressed object, not illustrated, the oscillation amplitudes are registered continuously via the sensor 2.4. After that, a permissible oscillation amplitude for the packing press 1 is registered within the controller 16.2 as a "normal condition" for the time and/or distance increments of the relative movements.

Then, an "alarm value" with a magnitude 20% higher than the maximum measured value of the oscillations in the normal condition is generated, and a "shut-off value" having a magnitude 40% higher than the previous maximum measured value is generated and the two limiting values are entered into the controller 16.2 of the press 1 for each time and/or distance increment, with the effect of an incremental memory.

The operation of the press is ultimately managed, completing the series of steps according to the invention, by the use of a program integrated into the controller 16.2, in such a way that

- a) in a learning phase, the maximum oscillation amplitudes during the various relative movements belonging to the pressing cycle or the movement increments are recorded,
- b) automatic generation of the "alarm" and "shut-off values" is carried out,
- c) in the actual active phase, the measured values of the oscillation amplitudes during the pressing operation are registered and compared

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continuously with the respective associated
"alarm and shut-off values" belonging to the
distance and/or time increment,

- 5 d) appropriate actions are triggered automatically
if the values are exceeded.

The idea of an incremental memory is used completely in
the system for monitoring the operating condition of
the packing press in order to achieve the object,
10 namely the prevention of "fretting" of relevant machine
parts, in that "alarm" or "stop" are triggered
automatically when a current measured value goes beyond
a tolerance value.

15 It is expedient to indicate the values "normal
condition", "alarm value" and "shut-off value" on a
monitor, not designated, of an operator guidance system
in the controller 16.2 of the packing press 1.

20 **Commercial applicability**

Although its effect is associated with substantially
increased serviceability for the operator of machines
of the generic type, the invention may be implemented
25 with relatively simple means, even retrofitting
according to the invention of presses already in
operation being unproblematic.

D334**List of designations**

- 1 = Shear packing press
- 2.1 = Hopper
- 2.2 = Press case
- 2.3 = Pack chamber
- 2.4 = Sensor
- 3.1 = First compactor
- 3.2 = Second compactor
- 3.3 = Third compactor
- 5.1 = Door
- 5.2 = Door case
- 6.1 = First piston/cylinder unit
- 6.2 = Second piston/cylinder unit
- 6.3 = Third piston/cylinder unit
- 6.4 = Fourth piston/cylinder unit
- 9.1 = Hydraulic drive system
- 9.2 = Control block
- 10 = Tie rod
- 13 = Hydraulic tank
- 16 = Switch cabinet
- 16.1 = Coupler/charge amplifier
- 16.2 = Controller
- 16.3 = Measuring line
- 16.4 = Connecting cable